In Nagoya University, safety management in each laboratories have been supported by using a comprehensive database, in which information that is necessary for risk control, such as local exhaust ventilation (LEV) facilities, stocks of chemicals and compressed gas cylinders, occupational health actions, and hazardous wastes, is installed together. Environment, Health & Safety Office (EH&SO) is responsible for whole legal and safety actions on all LEV facilities, such as registration on Labor Standard Bureau (LSB), check of annual inspection and maintenance, and performance of safety training. Since fume hoods have been used as the most common LEV facilities in the campus, the training course carried out by EH&SO consists of the followings: (1) basic course for daily check and maintenance of fume hoods in the laboratory by end users, (2) official training for licensed inspectors of fume foods.

**Keywords:** compliance, comprehensive laboratory database for safety management, fume hoods, inspector training, legal inspection on LEV, local exhaust ventilation (LEV), safety training

1. Introduction

Local exhaust ventilation (LEV) is a basic infrastructure in laboratories to protect the workplace from hazardous substances. Installation of LEV is legally required in Japan to prevent workers from occupational hazard caused by vapor of organic solvents and specified chemicals and chemical dust. LEV facilities must be registered and authorized before installation, and, after operation, it is compulsory to pass on an official inspection in every year. At almost all chemical laboratories in Nagoya University, a fume hood has been used as the major LEV facilities for handling of chemical substances. However, it has been particularly difficult to comply these regulations on installation and inspection of all fume hoods completely, because there are thousands students and researchers (end users) using about 1,000 facilities distributing all over the campus. Until 2014, whole management business of fume hoods was carried out by each faculty or institute, to which the instruments belonged, and, therefore, the maintenance level was significantly different depending on the faculty. Furthermore, there were less than 10 licensed technicians who could be engaged in the technical inspection of LEV in the campus in 2014. It was urgent to avoid misconduct on the regulations and to keep laboratory safety at higher level, and a new overall management system and rule, that is Chemical Safety Management Regulations (CSMR, Nagoya University, revised in Sep. 2014), were established, which includes guidelines for purchasing and setting of the LEV facilities, safety education and training for users, and scheduled check and maintenance. EH&SO is provided as an administration center concerning to chemical hazard, and is responsible not only for training of the fume hood users but also for monitoring the compliance with rules on fume hoods. In order to help the complicated business, a comprehensive laboratory database for control of chemical risk has been established. Describes herein is the outline of the fume hood management and training in Nagoya University.

2. A comprehensive laboratory database and LEV system in Nagoya University

In Fig. 1, a copy of the starting page of the comprehensive laboratory database named as “Nagoya University Environment, Health & Safety Data Management” is shown. Officers engaged in design, maintenance, and safety management of laboratories at the central and faculty office are allowed to access in it, but only a limited staffs at EH&SO are allowed to modify or update the data. It has been established since 2013 by using Microsoft Access software, and includes the information about principal investigator (PI), basic information (location, floor area and so on) of the laboratory, fume hoods located in the laboratory, maintenance level of the fume hoods, concentration of hazardous vapor in laboratory atmosphere, results of special health examination of chemical users, results of safety inspections on chemicals and compressed gas cylinders, and license holders on treatment of chemical wastes and compressed gas. The database links with MaCS-NU and MaCS-G, those are centralized database on the stock of chemical substances and gas cylinders, respectively.
All fume hoods in the campus have a unique registration number, and a yearly label is issued when they pass in the annual inspection. The number links with not only basic information such as the name of corresponding person user (PI) and history, location, maker and type of the hood but also recent results on annual inspection (conditions and capacities) which guarantee to be usable as a safety equipment in the laboratory.

According to Specified Chemical Ordinance and Organic Solvent Ordinance of Industrial Safety and Health Act, it is the formal procedure to submit information of newly installed LEV system to Labor Standard Bureau (LSB) in 30 days prior. Following to CSMR guidelines, technical data sheets necessary to the registration of newly purchased fume hoods are required to be prepared by the company of installation in advance, and then the copy of the submitted documents is concurrently sent to EH&SO for uploading to the laboratory database. It is recorded in the database together with all detailed information about supplier, model, efficiency, building and room to be installed, responsible person of laboratory etc.

3. Special training for restricted inspector on fume hood in academic laboratory

It is mandatory that the annual inspection of LEV is carried out by an inspector with an official license, and public training for the inspector requires 17-hour (at least 3 days) schooling. It costs about JPY75,000 per person, and the training course is only available for a limited number of participants at Tokyo or Osaka. Therefore, it is not possible for general laboratory staffs (PI, researchers, and students) to attend the schooling. Due to the reasons, there were only less than 10 official inspectors for fume hoods in the campus in 2014. It is important to increase the number of end users who know about occupational health and the mechanism of fume hoods in the campus for improving laboratory safety, and EH&SO planned to hold private safety education and training on fume hoods for general laboratory users as well as official inspectors.

From the official training curriculum for general LEV inspectors, several subjects which are not necessary for the inspection of fume hoods at the academic laboratory are omitted, and the private training curriculum in Nagoya University is required shorter schooling period. Furthermore, the training course is divided into course A (3 h 45 min) and course B (3 h 55 min) as shown in Table 1, and both courses

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Contents of Course A and Course B</th>
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<tbody>
<tr>
<td><strong>Course A</strong></td>
<td><strong>Training time</strong></td>
</tr>
<tr>
<td>Lecture</td>
<td>Subject</td>
</tr>
<tr>
<td>General occupational health</td>
<td>45 min</td>
</tr>
<tr>
<td>Regulations of occupational health</td>
<td>45 min</td>
</tr>
<tr>
<td>Basic knowledge of fume hood</td>
<td>2 h 15 min</td>
</tr>
<tr>
<td>Total time</td>
<td>3 h 45 min</td>
</tr>
<tr>
<td><strong>Course B</strong></td>
<td><strong>Training time</strong></td>
</tr>
<tr>
<td>Lecture</td>
<td>Subject</td>
</tr>
<tr>
<td>Guideline of regular voluntary check of local exhaust ventilation</td>
<td>1 h 10 min</td>
</tr>
<tr>
<td>Practical training</td>
<td>Ability check methods on hood, duct and exhaust</td>
</tr>
<tr>
<td></td>
<td>Fan and electric motor check methods</td>
</tr>
<tr>
<td>Total time</td>
<td>3 h 55 min</td>
</tr>
</tbody>
</table>
would finish in a half day. Thus, a new training course for academic inspectors restricted to fume hoods on the campus has been established since 2014.

Course A is carried out in a class with 50 – 100 participants, and it covers basic and general knowledge of occupational health, legal regulations on occupational health and LEV, and basic technique of LEV. CSMR require that it is necessary for all chemical laboratories to have at least one person who finished course A.

Course B (Fig.2) is carried out in a small class with 5 – 10 trainees who have finished course A, and mechanical and technical knowledge and practice of inspection and maintenance are trained there. A trainee who finished the both courses receives an allowance as a fume hood inspector in Nagoya University. Since the training programs has been authorized by LSB, the inspector can be engaged in the official inspection on fume hoods in Nagoya University.

Course A was held in 3 and 2 times in 2014 and 2015, respectively, and course B was held in 7 and 3 times in 2014 and 2015, respectively. There have been 261 trainees who completed course A, and 68 trainees have completed course B. The training is announced on May, and registration is necessary to attend the courses several weeks in advance.

4. Discussion

It is common that many fume hoods are used without sufficient maintenance in laboratories of Japanese universities. In addition, there are many cases of misuse, for example treating strong acid or perchloric acid in a steel hood, using hot materials or fire in a plastic hood, and using hydrogen fluoride in a general hood. To avoid accidents and to keep LEV in better conditions, the end user must understand about LEV system. In order to prevent troubles regarding LEV, daily check and maintenance by end user themselves are most efficient. Further improvement of end-users’ training is still the priority issue for EH&SO managers in university.

Although tangible progress has been recently made toward effective fume hood management based on development of an adequate education system for LEV users in Nagoya University, there are a number of issues that have to be improved. Some of these issues are outlined below.

4.1 Improvement of the training contents

Due to CSMR guidelines many end users in chemical laboratories have finished to take course A. However, they are not familiar with practical technique about “daily” fume-hood check or maintenance that is not included in the current course A. e-Learning contents of course A for study by themselves are requested by some attendants, and it seems to be useful to educate the related knowledge.

In the last year, new type fume hoods which save electric power have been installed in newly built laboratories, but the modern LEV instruments have not been mentioned in the courses. It is necessary to update course B contents regularly based on new needs of trainees.

4.2 Follow-up

There is no validation period on these trainings and reeducation is not required for both course A and B. However, after several years later an effective follow-up training for qualified inspectors who have finished the regular courses would be necessary, and it would be a future task for EH&SO.

4.3 Improve the comprehensive laboratory database

The database is useful for managers in EH&S, but it has not been used in the office or departments of Nagoya University. It is not familiar in the campus or open to all person who is engaged to EH&S actions in the campus. Therefore, improvement to adapt the database in other fields related to EH&S in university is also considered.

References

2) Industrial Safety and Health Act:
http://www.japaneselawtranslation.go.jp/law/detail/?id=1926&vm=&re=

3) Ordinance on Prevention of Organic Solvent Poisoning:
   https://www.jniosh.go.jp/icpro/jicosh-old/japanese/country/japan/laws/03_rel/05_organicsolvent_reg/index.html

4) Nagoya University home page (in Japanese):
   http://kisoku.jimu.nagoya-u.ac.jp/kisoku/act/frame/frame110000232.htm

5) MaCS-NU system home page:
   http://macs.esmc.nagoya-u.ac.jp/iasor6/cfw/cfw01/CFW0101/
   .jsessionid=A5B2A054619A81F6BBE362724F6447ED

6) MaCS-G system home page:
   http://macs.esmc.nagoya-u.ac.jp/iasor6/cfw/cfw01/CFW0101/
   .jsessionid=A5B2A054619A81F6BBE362724F6447ED